
A36 Mild Steel Hot Rolled – Technical Material Specification

1.0 Material Overview & Common Uses

A36 is a low-carbon mild steel (typically 0.25–0.29% carbon) produced via hot rolling, conforming to ASTM A36 / A36M. It offers good weldability, moderate strength, and excellent formability, making it the most widely used structural steel in North America.

- Primary applications: structural beams, columns, bridge components, industrial machinery frames, storage tanks, pressure vessels (low-pressure), and general fabrication.
- Common product forms: hot-rolled plate (1/8" to 8" thick), sheet, flat bar, angle, channel, I-beam, and round/square bar.
- Not suitable for high-temperature service (above 400°C) or cryogenic applications due to loss of toughness.

2.0 Core Technical Properties & Sizing

- Density: 7.85 g/cm³ (0.284 lb/in³)
- Tensile strength: 400–550 MPa (58–80 ksi)
- Yield strength (minimum): 250 MPa (36 ksi) for plates ≤ 8" thick; 220 MPa (32 ksi) for shapes > 8"
- Elongation in 2": 20% minimum (for plate ≤ 3/4" thick)
- Hardness: typically 120–140 HB (Brinell) as-rolled
- Melting point: approximately 1425–1460°C (2600–2660°F)
- Thermal expansion coefficient: 11.7×10^{-6} /°C (20–100°C)
- Standard plate sizes: 48" × 96", 48" × 120", 60" × 120", 72" × 144"; thickness tolerance per ASTM A6/A6M (e.g., ±0.010" for 1/4" plate)
- Flatness tolerance: 1/4" in any 3 ft for plates up to 1/2" thick (per ASTM A6)
- Squareness tolerance: ±1/16" per foot of width or length for sheared edges

3.0 Processing, Machinability & Application

A36 is rated as having good machinability (approximately 70% of free-machining 1212 steel). It produces continuous chips and requires adequate chip control. Carbide tooling is recommended for production runs; high-speed steel (HSS) is acceptable for low-volume work.

- Turning: use carbide inserts with a feed rate of 0.008–0.015 in/rev and cutting speed of 250–400 SFM (HSS: 100–150 SFM).
- Milling: use 4-flute carbide end mills at 0.002–0.005 in/tooth feed, 250–350 SFM; climb milling preferred to reduce work hardening.
- Drilling: use HSS or cobalt twist drills at 50–80 SFM with pecking cycle for holes deeper than 3× diameter; flood coolant recommended.
- Welding: excellent weldability with all common processes (SMAW, GMAW, FCAW, GTAW, SAW). No preheat required for thicknesses under 1"; preheat 50–100°C for 1–2" sections; maintain interpass temperature below 315°C.

- Filler metals: ER70S-6 (GMAW), E7018 (SMAW), or E71T-1 (FCAW). No post-weld heat treatment typically required.
- Forming: can be cold bent to a minimum radius of 2× thickness for plate up to 1/2"; hot forming at 900–1100°C with slow cooling.
- Cutting: plasma, laser, or abrasive waterjet preferred for clean edges; oxy-fuel cutting acceptable for thicknesses above 1/2".

4.0 Common Defects & Quality Control

- Reject if surface laminations or seams exceed 0.010" depth as measured by magnetic particle inspection.
- Reject if surface pitting or scale pits exceed 0.005" depth on any face intended for painting or welding.
- Reject if edge camber (bow) exceeds 1/4" in any 10 ft length for bars or shapes.
- Reject if twist (helical distortion) exceeds 1° per 5 ft for structural shapes.
- Reject if flatness deviation exceeds 1/4" in any 3 ft for plates under 1/2" thick, or 3/8" in 3 ft for thicker plates.
- Reject if thickness is below the minimum tolerance per ASTM A6 (e.g., 0.230" for nominal 1/4" plate).
- Reject if chemical analysis shows carbon > 0.29%, manganese > 1.20%, or silicon > 0.40% (per ASTM A36 limits).
- Reject if tensile strength is below 400 MPa or yield below 250 MPa on certified mill test report.

5.0 Storage, Handling & WHMIS Guidelines

- Store indoors in a dry, well-ventilated area; relative humidity below 60% to minimize surface rust formation.
- If outdoor storage is unavoidable, elevate material on dunnage (minimum 4" off ground) and cover with breathable tarps; do not use plastic sheeting that traps moisture.
- Shelf life: indefinite if stored properly; inspect for rust pitting every 6 months and apply light oil or rust inhibitor if needed.
- FIFO protocol: rotate stock so that older material is used first; mark receipt date on each bundle or plate.
- WHMIS classification: Not classified as a hazardous product under WHMIS 2015 in solid form. Dust, fume, or grinding particles may be hazardous.
- Hazards during processing: welding fume (manganese, iron oxide) – use local exhaust ventilation; grinding dust – avoid inhalation; sharp edges – cut hazards.
- Mandatory PPE: safety glasses with side shields, cut-resistant gloves (ANSI A4 or higher), steel-toed boots, and hearing protection when sawing or grinding.
- Welding PPE: auto-darkening welding helmet (shade 10–13), flame-resistant jacket, welding gloves, and leather apron.
- First aid: for cuts, clean and bandage; for eye injury from metal chips, flush with water for 15 minutes and seek medical attention.

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